

## **TOPICS IN MEDICAL MICROBIOLOGY FOR EXAM SESSION**

### **English-speaking students in Dental medicine**

#### **Part I – General microbiology**

1. Subject and tasks of microbiology. The role of Pasteur and Koch for development of medical microbiology. Taxonomy of microorganisms – nomenclature and classification. General characteristics of different groups of microorganisms.
2. Morphology of bacteria – shape, size, arrangement. Methods for studying bacterial morphology. Bacterial structure – essential and nonessential components: cell envelope, cytoplasm and cytoplasmic inclusions, capsules, flagella, fimbriae, spores.
3. Bacterial genetics. Genotype and phenotype of bacteria. Genetic apparatus in bacteria. Bacterial chromosome as a genetic system. Extrachromosomal genetic elements. Bacteriophages – main types, structure, interactions with the microbial cell – lytic cycle, moderate phage, prophage, phage conversion. Phage typing.
4. Microbial mutability. Mutations. Mutagenic factors – chemical and physical, mechanism of action, practical use. Genetic transfer – transformation, conjugation, transduction – mechanisms. The importance of bacterial and phage genetics. Genetic engineering. Contemporary genetic methods in clinical microbiology. DNA probes. PCR – polymerase chain reaction.
5. Bacterial physiology. Chemical composition of bacterial cell. Bacterial enzymes. Bacterial metabolism – catabolic and anabolic processes. Bacterial respiration. Bacterial nutrition. Transport of nutrients.
6. Bacterial growth and reproduction. Growth phases and growth curves. Bacterial culture – basic principles, culture media. Bacterial growth factors.
7. Influence of physical factors on microorganisms: heat, drying, light, atmospheric pressure, osmotic pressure, radiation, pH, ultrasound. Sterilization. Methods of sterilization. Influence of chemical factors on microorganism. Disinfection, types of disinfectants. Characteristics (special features) of disinfecting and sterilizing procedures in the dental practice. Mechanism of action of chemicals upon bacteria. Oligodynamics. Influence of biological factors upon microorganisms: symbiosis, antagonisms, antibiosis.

8. Antimicrobial agents. Main groups, spectrum and mechanism of action. Mechanisms of resistance to antimicrobial agents. Antibiotic susceptibility tests.
9. Viruses. Nature and properties. Methods for cultivation. Classification. Rickettsia. Nature and properties. Methods for cultivation. Classification.

## **Part II – Infection and Immunity**

10. Infection and infectious process. The role of microorganism in the infectious process. Pathogenic factors – pathogenicity, virulence, invasiveness, toxigenicity. The role of macroorganism in the infectious process. The role of environment for development and course of the infectious process. Epidemic process. Factors and mechanisms of transmission of the infectious agents in the epidemic process.
11. Characteristics of infectious disease. Pathogenesis. Forms of the infectious process. Focal infection in the oral cavity. The oral cavity as route of entry of pathogens, causing local and systemic infections. Pathogenic mechanisms associated with microorganisms in the oral cavity.
12. Innate immunity – characteristics and basic forms. The protective role of innate immunity in the oral cavity – the importance of the anatomical barriers, the saliva and gingival crevicular fluid. Protective role of the normal oral flora. Humoral and cellular factors of innate immunity – lysozyme, complement system, interferons and cytokines, phagocytosis. The protective role of inflammation in the oral cavity. Microbial factors counteracting the mechanisms of the natural resistance.
13. Immunity. Definition. Types of immunity. The protective role of adaptive immunity in the oral cavity. Microbial factors counteracting the mechanisms of the adaptive immunity.
14. Anatomy and structure of the immune system. Primary and secondary organs. Cells of the immune system. Development of the immunocompetent cells – positive and negative selection.
15. Antigens. Types of antigens. Antigenic characteristics of microorganisms. Humoral immunity. Characteristics of antibodies (immunoglobulins). Structure and function of different immunoglobulin classes. Mechanism of action of antibodies. Local immunity. Monoclonal antibodies.
16. Cellular immunity. Cells and mechanism of action. Types of cellular immunity. Cellular cooperation in the immune response.
17. Development of the immune response. Recognition of antigens. The role of APC and MHC molecules. Dynamics of the immune response – primary and secondary immune response. Genetic control of the immune response. Humoral regulation of the immune response.

18. Allergy – definition and types. Immediate allergic reactions – anaphylaxis, atopy, clinical significance. Cytotoxic allergic reactions. Allergic phenomena due to immune complexes – serum sickness, Arthus phenomenon, clinical significance. Delayed type hypersensitivity – tuberculin skin test (Mantoux), contact dermatitis. Clinical significance of hypersensitivity in Dental medicine.
19. Immunopathology. Immunopathological reactions and diseases. Immunological tolerance. Autoimmune diseases. Immunodeficiencies – disorders and diseases. Infections in patients with immunodeficiency syndromes. Role of the microorganisms of the normal oral flora as causative agents of opportunistic infections. Infectious diseases of the immune system.
20. Antigen-antibody reactions. Types: agglutination, precipitation, neutralization, complement fixation test. Labelled immune reactions – immunofluorescence, radioimmune and immunoenzyme tests. Mechanisms and practical application of the reactions in microbiological diagnosis.
21. Immunoprophylaxis and immunotherapy. Vaccines and sera. Immunomodulation.

### **Part III – Special microbiology**

22. Microbiological diagnosis of infectious diseases. Methods and algorithm of the microbiological examination of specimens – direct microscopy, isolation and identification of microorganisms; serological diagnosis; modern molecular – biological tests.
23. *Staphylococcus* spp. Classification. Morphology, biology. Pathogenic factors. Pathogenicity, diseases and immunity. Microbiological diagnosis. Antimicrobial treatment. MRSA – clinical importance and diagnosis.
24. *Streptococcus* spp. Classification. Morphology, biology, antigenic structure. Pathogenic factors. Pathogenicity of streptococcal infections. Diseases and immunity. Microbiological diagnosis. Antimicrobial treatment. Streptococci as resident flora in the oral cavity. *Streptococcus pneumoniae*. Morphology, biology, biochemical production and antigenic structure. Pathogenesis, diseases and immunity. Microbiological diagnosis. Specific prophylaxis and therapy.
25. Gram-negative bacteria causing air-borne infections. *Haemophilus influenzae*. Morphology, biology, antigenic structure. Pathogenic factors. Diseases. Immunity. Microbiological diagnosis. Specific prophylaxis and therapy. The causative agent of Whooping cough (*Bordetella pertussis*). Morphology, biology. Pathogenic factors. Pathogenicity and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Neisseria meningitidis*. Morphology, biology. Pathogenic factors. Pathogenicity and clinical forms of meningococcal infection. Immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Neisseria gonorrhoeae*. Morphology, biology. Pathogenic factors. Pathogenicity and clinical forms of gonococcal infection. Immunity. Microbiological diagnosis. Prophylaxis and therapy.

26. Enterobacteriaceae family. Main groups enteric bacteria concerning their pathogenicity. General characteristics – morphology, biology, antigenic structure, pathogenic factors. Opportunistic enteric bacteria – *Escherichia coli*, *Klebsiella*. Diseases. Microbiological diagnosis.
27. *Salmonella*. General characteristics – morphology, biology, classification, antigenic structure, pathogenic factors, diseases, microbiological diagnosis. Dysentery (*Shigella* spp.). Characteristics and microbiological diagnosis. *Pseudomonas*. Morphology, biology, pathogenic factors. Diseases. Microbiological diagnosis. Therapeutical problems.
28. Causative agents of infections with high biological risk (*Yersinia pestis*). Morphology, biology, pathogenic factors. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Vibrio cholerae*. Morphology, biology, antigenic structure, serotypes. Pathogenic factors. Microbiological diagnosis. Specific prophylaxis and therapy. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Bacillus anthracis*. Morphology, biology. Pathogenesis and clinical forms. Immunity. Specific prophylaxis and therapy. Microbiological diagnosis.
29. *Corynebacterium* spp. *Corynebacterium diphtheriae*. Morphology, biology, pathogenic factors. Pathogenicity and immunity. Microbiological diagnosis of diphtheria. Specific prophylaxis and therapy. Coryneforms (*C. jeikeum*, *C. urealyticum*, *C. amycolatum*, *C. pseudodiphtheriticum*). Clinical importance. Mycobacteria. *Mycobacterium tuberculosis*. Morphology, biology. Pathogenicity, clinical forms and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Mycobacterium leprae*. Morphology, biology, pathogenesis, clinical forms. Microbiological diagnosis. Prophylaxis.
30. Anaerobic spore-forming bacteria – genus *Clostridium*. General characteristics. Morphology, biology. *Clostridium tetani*. Toxin production. Pathogenicity and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. The causative agents of gas gangrene (*C. perfringens*, *C. oedematiens*, *C. septicum*, *C. histolyticum*). Pathogenic factors. Pathogenicity and immunity. Microbiological diagnosis. Prophylaxis and therapy. *Clostridium botulinum*. Toxin production. Pathogenesis and immunity. Microbiological diagnosis. Prophylaxis and therapy.
31. Anaerobic non-spore forming bacteria. Anaerobic Gram-positive round- and rod-shaped bacteria. Genus *Peptostreptococcus*, *Propionibacterium*, *Lactobacillus* and *Eubacterium*. Anaerobic Gram-negative round- and rod-shaped bacteria. Genus *Bacteroides*, *Fusobacterium*. The role of the anaerobic non-spore forming bacteria in the etiology of infectious processes in the oral cavity.

32. Spirochetes (Spirochaetaceae). General characteristics. The causative agent of syphilis (*Treponema pallidum*). Morphology and biology. Pathogenesis and immunity. Microbiological diagnosis. *Leptospira* spp. Morphology and biology. Antigenic structure and serological types. Pathogenesis and immunity. Microbiological diagnosis. The causative agent of Lyme Disease (*Borrelia burgdorferi*). Pathogenesis, immunity, microbiological diagnosis.
33. *Mycoplasma* spp. Classification. Morphology, biology, diseases. Microbiological diagnosis. L-forms of bacteria. Chlamydia. General characteristics. Species. Morphology and biology. Pathogenesis and disease. Microbiological diagnosis. Pathogenic fungi.
34. *Candida* spp. and Actinomycetaceae family. Morphology, biology. Pathogenesis and diseases. Microbiological diagnosis. Therapy.
35. The causative agent of louse-borne typhus (*Rickettsia prowazeki*), Mediterranean fever (*Rickettsia conorii*), Q fever (*Coxiella burnetii*), human ehrlichiosis (*Ehrlichia*) and cat-scratching disease (*Bartonella henselae*). General characteristics – classification, morphology, biology, pathogenesis and immunity. Microbiological diagnosis, diseases, therapy.
36. Pathological processes in the oral cavity, caused by microorganisms – caries, diseases of pulp and periapical tissues; periodontal diseases, diseases of the oral mucosa.
37. Picornaviridae. Genus Enterovirus – the causative agent of poliomyelitis, coxsackie infections and ECHO infections. Genus Rhinovirus – the causative agents of infectious rhinitis. Genus Adenovirus – the causative agent of foot-and-mouth disease.
38. Orthomyxoviridae. The causative agents of grippe. Paramyxoviridae. The causative agents of paragrippe, epidemic parotitis, measles. Respiratory syncytial virus. Coronaviruses. SARS-CoV-2 and the disease COVID-19.
39. Arboviruses – the causative agents of vector-associated infections. General characteristics and classification. Genus Rubivirus. Bunyaviridae – the causative agent of Crimean-Congo haemorrhagic fever.
40. Retroviridae – the causative agent of AIDS (HIV). Rhabdoviridae – the causative agent of rabies. Adenoviridae. Poxviridae – the causative agent of smallpox.
41. Herpesviridae. The causative agent of herpes simplex type 1 and type 2, the causative agent of varicella and herpes zoster. Human Cytomegalovirus. The causative agent of infectious mononucleosis. Other herpesviruses.
42. The causative agents of viral hepatitis (HAV, HBV, HCV, HDV, HEV). Characteristics. Pathogenesis and immunity. Specific prophylaxis.

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